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SONG, MATTHEW J	
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Please find below and/or attached an Office communication concerning this application or proceeding.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 9/23/2004 has been entered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claim 1 and 36 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 1 recites, " pre-reaction chamber serially aligned down stream only with said reaction chamber" in lines 8-9. There is no support in the instant specification for the pre-reaction chamber serially aligned down stream **only** with said reaction chamber. The term "only" is never used in the instant specification. Likewise for claim 36.

4. Claim 1 and 36 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 1 recites, " pre-reaction chamber serially aligned down stream only with said reaction chamber" in lines 8-9. The instant specification merely teaches the pre-reaction zone is merely upstream of the reaction chamber (pg 7) and the substrates are arranged serially (pg 9), not the reaction chamber and pre-reaction chamber. Likewise for claim 36.

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 1 and 36 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 1 recites, " pre-reaction chamber serially aligned down stream only with said reaction chamber" in lines 8-9. It is unclear how "only" is intended to limit the claim. In other words, would an exhaust line serially aligned with the pre-reaction chamber would be excluded?

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1-5, 7-9, 11-13, 16-18, 20, 22-25 and 36 are rejected under 35 U.S.C. 102(b) as being anticipated by Suntola et al (US 6,015,590).

Suntola et al discloses an apparatus for ALE comprising four reaction chambers **13** having substrates **12** onto which thins films are grown using the ALE process, where vapor phase reactants are feed into a reaction space in the form of vapor phase pulses repeatedly and alternately and evacuating the reaction space between successive pulses (claim 1 and col 3, ln 1-67). Suntola et al also discloses a reactant inflow channel **7** for metallic reactants such as $TiCl_4$, $ZnCl_2$, hydrogen sulfide and sulfur (col 4, ln 45-60, col 8, ln 30-67 and Fig 1). Suntola et al also teaches starting materials are isolated from each other thus preventing their pre-mature mutual reactions and such reactions occur in the gas phases resulting in a CVD thin film (col 7, ln 5-67). Suntola et al also teaches a design target of less than 1% of residual components of a preceding vapor phase reactant pulse remaining at the infeed of the next pulse and the reaction space can be purged to less than 1 ppm of reactant residues from the preceding pulse (col 5, ln 10-35 and col 3, ln 25-40). Suntola et al also discloses the "reaction space" includes the space in which the substrate is located and the gas inflow channels communicating with the reaction chamber (col 4, ln 25-50). Suntola et al also discloses a substrate is place in a reaction space (Abstract and Claim 1)

Referring to claims 1 and 36, Suntola et al discloses feeding a vapor phase pulse, purging the reactor to less than 1% of residual components and feeding in a second vapor phase pulse, as applicant. Suntola et al is silent to a reaction product is formed. This is inherent to Suntola et al

because Suntola et al teaches a similar residual amount of first reactant, as applicant (note instant claim 22), and similar reactants, as applicant (note pg 7 of the instant specification); therefore a reaction product is inherently formed.

Also, referring to claim 1 and 36, Suntola et al discloses a inlet slit **8**, this reads on applicant's pre-reactor, serially aligned downstream only with the reaction chamber **13**, this reads on applicant's second reaction chamber. The walls of the inlet slit **8** read on applicant's first substrate because reactants deposit on the walls of the inlet slit as undesired film growth (col 8, ln 10-17) and substrates **37** in the reaction chamber reads on applicant's second substrate. The flow of gases and the position of the substrates inherently requires the first reactant and second reactant to be feed over the first substrate and subsequently over the second substrate.

Referring to claim 2, Suntola et al discloses a vapor phase reactant pulse (col 9, ln 10-20).

Referring to claim 3, Suntola et al discloses molecules adsorbed on the inner walls of the system (col 8, ln 10-17).

Referring to claim 4, Suntola et al discloses a inlet slit **8**, this reads on applicant's pre-reactor, upstream from the reaction chambers **13**, this reads on applicant's second reaction chamber.

Referring to claim 5, Suntola et al discloses an ALE process, this reads on applicant's ALD, for forming a thin film on substrates **12** placed in the reaction chambers **13**.

Referring to claim 7, Suntola et al discloses the piping, this reads on applicant's pre-reactor, is evacuated such that the residual vapor phase reactant is less than 1% (col 5, ln 10-35).

Referring to claim 9, Suntola et al discloses feeding vapor phase reactants alternately (claim 1).

Referring to claim 11, Suntola et al discloses a plurality of vapor phase reactants (claim 1).

Referring to claim 12 and 16, Suntola et al discloses feeding a vapor phase pulse, purging the reactor to less than 1% of residual components and feeding in a second vapor phase pulse and the temperature of the reactor and pre-reactor are the same temperature, as applicant. Suntola et al is silent to the second vapor phase reactant reacts with the residual first vapor phase reactant under conditions conducive to chemical vapor deposition. This is inherent to Suntola et al because Suntola et al teaches a similar residual amount of first reactant, as applicant (note instant claim 22), and similar reactants, as applicant (note pg 7 of the instant specification); therefore a reaction product is inherently formed by CVD conditions.

Referring to claims 13 and 36, Suntola et al discloses the pre-reactor 7 is placed immediately adjacent the second reactor 13 (Fig 1).

Referring to claim 14, Suntola et al discloses an inflow channel 28 for starting material of group B and an inflow channel 29 for a starting material of group A (col 10, ln 1-30 and Fig 2).

Referring to claims 15 and 36, Suntola et al discloses the inflow channels and intermixing in the inflow slit, this reads on applicant's pre-reactor (col 10, ln 40-55).

Referring to claims 8 and 17, Suntola et al discloses feeding a vapor phase pulse, purging the reactor to less than 1% of residual components and feeding in a second vapor phase pulse and the temperature of the reactor and pre-reactor are the same temperature, as applicant. Suntola et al is silent to the second vapor phase reactant reacts with the residual first vapor phase reactant to form a solid product so as to deplete the residual first vapor phase reactant. This is inherent to Suntola et al because Suntola et al teaches a similar residual amount of first reactant, as applicant

(note instant claim 22), and similar reactants, as applicant (note pg 7 of the instant specification); therefore a reaction product is inherently formed by CVD conditions

Referring to claim 18, Suntola et al discloses the "reaction space" includes the reaction chamber and the inflow piping (col 4, ln 29-45); therefore the "reaction space" would inherently be operated at the same temperature for ALE deposition.

Referring to claim 20, Suntola et al discloses molecules are adsorbed on the inner walls of the system, which includes the inlet slit 8 and the inflow channel 7. A reaction product is inherently formed in the inlet slit and the inflow channel 7, as discussed previously, which respect to claim 1. The walls of the inlet slit 8 or the inflow channel 7 reads on applicant's removable medium positioned upstream of the substrate 37 and downstream of a point where both the first and second vapor phase reactants have entered the reaction chamber because parts of reactor inherently can be replaced, as evidenced by Soininen et al (US 5,855,680).

Referring to claim 22, Suntola et al discloses less than 1 ppm (col 5, ln 30-31).

Referring to claim 23, Suntola et al discloses less than 1% (col 5, ln 25-26 and Claim 1).

Referring to claim 24, Suntola et al discloses the reaction space is purged with an inactive gas during the interval between the reactant pulses (col 5, ln 10-30).

Referring to claim 25, Suntola et al discloses the reaction space is purged with an inactive gas and evacuated (col 5, ln 10-30).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 20-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suntola et al (US 6,015,590) in view of Soininen et al (US 5,855,680).

Suntola et al discloses all of the limitations of claim 21, as discussed previously, except the reaction product is removed from the pre-reactor by cleaning the walls.

In an apparatus for growing thin films, Soininen et al teaches in an atomic layer epitaxy (ALE) method points where undesired film growth occurs must be subjected at regular intervals to surface cleaning from grown films, this reads on applicant's reaction product is removed from the reaction chamber separately from the thin film, or the contaminated parts must be replaced by new ones (col 8, ln 35-50). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Suntola et al with Soininen et al because cleaning reduces part replacement.

Referring to claim 20, the combination of Suntola et al and Soininen et al teaches undesired film growth occurs on other surfaces of a reaction chamber which can be replaced, this reads on applicant's discardable substrate.

Referring to claim 21, the combination of Suntola et al and Soininen et al teaches cleaning the undesired deposition.

11. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Suntola et al (US 6,015,590) in view of Mochizuki et al (US 5,166,092).

Suntola et al discloses all of the limitations of claim 26, as discussed previously, except the pressure of the reaction chamber is in the range of 1 to 100 mbar.

In a method of growing a compound film by atomic layer epitaxy, note entire reference, Mochizuki et al teaches a pressure dependency of the thickness of a grown GaAs layer per material supply cycle and a satisfactory GaAs molecular layer is obtainable in a pressure range of approximately 7 Torr to 60 Torr (9.3 to 80 mbar) (col 6, ln 65 to col 7, ln 5 and Fig 10). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Suntola et al with Mochizuki et al's pressure to produce a satisfactory GaAs molecular layer.

The combination of Suntola et al and Mochizuki et al teach a pressure range of 9.3 to 80 mbar. The combination of Suntola et al and Mochizuki et al does not teach a pressure range of 1 to 100 mbar. Overlapping ranges are held to be obvious (MPEP 2144.05).

Response to Arguments

12. Applicant's arguments with respect to claims 1-5, 7-9, 11-13, 16-18 and 21-26 have been considered but are moot in view of the new ground(s) of rejection.

13. Applicant's arguments filed 9/23/2004 have been fully considered but they are not persuasive.

Applicants' argument that Suntola et al does not teach a pre-reaction chamber being serially aligned downstream only with the reaction chamber is noted but is not persuasive. Applicants allege that the inflow channel 7 is not serially aligned with the reaction chamber. The

Examiner has changed the grounds of the rejection to overcome the new limitation by specifying the inlet slit **8**, taught by Suntola et al, is equivalent to the pre-reaction instantly claimed. The inlet slit **8** is a serially aligned with the reaction chamber **13**, note Fig 1.

Applicants' argument regarding claim 20 is noted but is not persuasive. Applicants' allege that it is not possible to remove the inflow channel from the reaction chamber because it would require disassembling the reaction chambers. It is unclear why it is not possible to disassemble an apparatus, in order to perform maintenance. Clearly, removal of the inlet slit or the inflow channel would be required should the part become defective or require maintenance.

Conclusion

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Suntola et al (US 4,389,973) teaches an apparatus of ALE comprising a reaction zone **18** and a substrate or substrates **11** place in the reaction zone (col 2, ln 5-67 and Fig 2).

Lan et al (US 4,780,174) teaches substrates held in series along the flow path of reactants (Fig 1), which reads on applicant's flowing of a first substrate and subsequently over a second substrate.

Lofgren et al (WO 99/51797) teaches at least two substrates in series along a gas flow path increases the growth rate in the sense that more objects may be grown at the same time (pg 5, ln 15-35).

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song
Examiner
Art Unit 1765

MJS

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SUPERVISORY PATENT EXAMINER